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A CREEL CENSUS ON LAKE NOQUEBAY, MARINETTE COUNTY, WISCONSIN, 1977

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ABSTRACT

A random stratified creel census was conducted on 2,409-acre Lake Noquebay, Marinette County, Wisconsin, between 7 May and 30 September 1977.

Fishing pressure during the 5-month census period was estimated at 82,758 hours, or 34.4 hours/acre.

The overall harvest rate was 1.28 fish/hour. Most of the catch was panfish, with bluegills comprising 73% of the total fish harvest.

The majority of the anglers interviewed fished Lake Noquebay specifically for panfish. Other characteristics of the lake's anglers are also given.

Implications of this creel census data for the management of the lake are discussed.

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INTRODUCTION

Lake Noquebay, with an area of 2,409 acres, is the largest lake in Marinette County, Wisconsin (Fig. 1). It is also one of the most popular lakes in the county for fishing, boating, and water skiing. Although numerous management surveys have been made of Noquebay's fish population (M. E. Burdick, unpubl. data), very little quantitative information exists on its sport fishery, or on the sport fisheries of most other lakes in Wisconsin. Data on fishing pressure, harvest, and angler attitudes is necessary before meaningful management strategies can be developed for these large bodies of water. The objective of this report is to provide this data for Lake Noquebay.

Lake Noquebay is located in southern Marinette County, about 17 miles northwest of the City of Marinette. Marinette County has a resident population of about 35,000. Marinette is the largest city in the county, with a population of approximately 13,000. An additional 12,000 people reside in its twin city, Menominee, Michigan. Major population centers lie at least 60 miles to the south.

Noquebay is a hard water drainage lake having slightly alkaline light brown water of moderate transparency. It has a maximum depth of 54 ft, although 87% of the lake is less than 20 ft deep (Fig. 2).

There are 3 inlets entering the lake. The outlet is tributary to the Peshtigo River. A dam on the outlet holds a head of about 2 ft. Invasion of the exotic water milfoil (Myriophyllum heterophyllum) in the shallow lake has led to a persistent aquatic macrophyte problem. A lake rehabilitation district has been formed, and an intensive weed harvesting program coupled with a winter drawdown is being tried to alleviate the macrophyte problem.

The lake contains a diverse fish population, with 29 species known to be present (Table 1). The dominant game fish are northern pike, largemouth bass, and walleye, while bluegills, pumpkinseeds, and yellow perch comprise the bulk of the panfish population. Walleye are the only species presently stocked in the lake.

There are more than 280 dwellings located around the shoreline of Lake Noquebay. Access can be obtained from a county park and 5 public boat launching facilities (Fig. 2).

METHODS

A random stratified creel census was conducted on Lake Noquebay for the period of 7 May through 30 September 1977. Methods used in this census follow those described by Lambou (1961).

The census clerk was able to make a complete count of all anglers on the lake within a 5-min. period. Angler counts were made at 2-hour intervals starting at 7:00 a.m. and running through 7:00 p.m. A final count was made at

8:00 p.m. Between counts, anglers were interviewed for information on the size of party; number, length, and species of fish caught; type of bait used; length of fishing trip; and angler's residence. (A sample of the census questionnaire used can be found in the Appendix.) If an angler was contacted more than once in the same day, only the time fished and catch since the previous contact were recorded.

More census effort was given to weekend days than to weekdays; holidays were treated as weekend days. An equal amount of effort was given to each month of the census and to each of the hourly time periods. The entire opening weekend of the 1977 fishing season was censused. Fifty percent of the remaining weekend periods and 30% of the weekday periods were sampled. The weekend and weekday data were analyzed separately, as were the data for each month.

Average daily fishing pressure was calculated by multiplying the average number of anglers/count, by the length of the period between counts, by the total number of counts/day. The total pressure for the period was then obtained by multiplying the average daily pressure for that period by the number of days in the period.

Harvest rates were obtained by dividing the total number of fish harvested, as shown on the interview forms, by the total number of hours fished, from the interview forms. The total number of fish harvested was obtained by multiplying the harvest rate by the estimated total fishing pressure. Harvest rates were calculated from data obtained from both complete and incomplete fishing trips.

A random sample of the angler's catch was measured to the nearest 0.1 in. and length frequencies were determined for each month of the census.

RESULTS AND DISCUSSION

Fishing Pressure

Lake Noquebay anglers fished 82,758 hours, or 34.4 hours/acre, between 7 May and 30 September 1977. This equates to 31,830 angler trips with an average completed trip length of 2.6 hours. This census covered only a 5-month period; thus the winter months were not censused, although a considerable amount of ice fishing occurs on Lake Noquebay. Those anglers fishing between the hours of 9:00 p.m. and 5:00 a.m. were not considered. If winter fishing and fishing in hours of darkness are taken into consideration, the number of angling hours/acre could likely be doubled.

Highest fishing pressure took place during the months of May and July, while the lowest occurred in September (Fig. 3). Weekends accounted for 46% of the total pressure, although only 1% occurred on opening weekend. Weekday pressure was higher during the summer months than it was in May or September. This was expected, as the Lake Noquebay area is considered a summer resort area. More anglers fished during the evening hours than at any other time of day (Fig. 4). During weekends, however, the midmorning hours received almost the same pressure as the evening hours.

The highest number of anglers counted at any one time on Lake Noquebay was 218 at 11:00 a.m. on Saturday, 28 May. This was on Memorial Day weekend and at a time when bluegill fishing was at its peak.

Fishing pressure on Lake Noquebay was comparable to that which has been observed on other Midwestern lakes. In general the larger lakes received less pressure/acre than did smaller lakes (Table 2). Considering that the census on Lake Noquebay covered only a 5-month period, Noquebay's fishing pressure was higher than that of the average lake.

Harvest

An estimated harvest of 109,413 fish, or just over 45 fish/acre, was taken from Lake Noquebay during the census period. No estimates were made of the number of fish caught and returned to the water.

The harvest included 11 different species of fish (Table 3). Panfish accounted for over 95% of the harvest, with bluegills alone making up 73% of the harvest. The primary game fish caught was the northern pike; it is interesting to note that many anglers kept small northern pike. Table 4 presents a breakdown of the average length of the various species in the harvest. Length frequency diagrams were made for the major species in the catch (Figs. 5-8). Figure 9 compares the harvest by month to the amount of fishing pressure. May was the best month for catching most species.

The overall harvest rate was 1.28 fish/hour. The highest rate was achieved in May, while the lowest was in September (Table 5).

A breakdown of the harvest rates in some other Midwestern lakes is given in Table 2. The rate for Lake Noquebay is definitely higher than the average. Those lakes in which panfish dominated the catch generally had the highest harvest rates. In Lake Noquebay bluegills not only constituted the bulk of the catch, but also had the highest harvest rate among species.

Angler Characteristics

When anglers were asked what kinds of fish they were looking for when fishing Lake Noquebay, 76% said panfish (Fig. 10). Northern pike was the principal game fish anglers sought.

Of those anglers interviewed, 59% were considered successful or had caught at least 1 fish. A completed fishing trip averaged just under 2.6 hours.

Males accounted for 79% of anglers fishing the lake. Anglers between the ages of 16 and 64 (those requiring fishing licenses) made up 69% of the total. Those younger than 16 accounted for 18%, and those 65 or over made up the remaining 13%.

The distance anglers traveled to fish Lake Noquebay is illustrated in Figure 11. Of those interviewed, 68% had driven over 50 miles. Eleven percent of the anglers were from out of state. These figures varied somewhat over the course of the census. In May, before the normal summer vacation period, 54% of the anglers lived within a 25-mile radius of the lake.

Anglers were also questioned as to the type of bait they used. Seventy-five percent used live bait, and most of these were fishing with worms (Table 6). The type of bait used varied little over the period of the census. The fact that most anglers were fishing for panfish helps explain the high usage of live bait.

COSTS/BENEFITS: CREEL CENSUS AND STOCKING PROGRAM

This creel census provided some very vital data about the water surveyed, and increased our knowledge of fishing pressure and harvest on Wisconsin lakes in general. The 5-month census, including manpower, travel expenses, data compilation, and report writing, cost approximately \$4,500. This cost does not seem inappropriate when one considers that this is the only extensive creel census ever conducted on Lake Noquebay, which has received over the past 15 years, an average stocking of 28,100 walleye fingerlings/year. Using 1977 figures, these plants would cost about \$815/year or \$12,225 over the 15-year period (John Klingbiel, pers. comm.). This is a substantial investment of money without knowing what kind of return we are getting.

The estimated harvest of walleyes from Lake Noquebay was 546 during the 5-month census period in 1977. If this estimate were doubled to account for winter as well as spring-summer fishing, an estimated 1,100 walleyes might be taken annually from Lake Noquebay. Assuming that all of these fish were the result of stocking, even though there is some natural reproduction in the lake, the minimum cost/creel walleye would be \$0.74. We should also consider that only 5% of the anglers fishing Lake Noquebay were pursuing walleyes. The walleye stocking program, then, probably benefits only a small group of the lake's users.

The summer fishing pressure on Lake Noquebay equates to about 31,800 angler trips. Spreading this pressure out evenly, there would be 38 anglers on the lake, 15 hours a day, 7 days a week, between May and 1 October.

A national survey of fishing and hunting (U.S. Department of Interior 1972) revealed that the average angler spent \$6.30 on an angling trip in 1970. Without adjusting this figure for inflation, over \$200,000 would probably enter the local economy each year just from the summer fishery on Lake Noquebay. This contribution makes the cost of obtaining good information for the proper management of the lake look like a bargain.

CONCLUSIONS

The fishing pressure on Lake Noquebay is relatively high. Reasons for the relatively high fishing pressure are only a matter of conjecture. However, when we examine what the anglers were after and what constituted the greatest part of the catch, we get some clues. The majority of the anglers were specifically after panfish. They caught these fish in large numbers, and the fish were of good size. Catch rates were better than average. The lake also has a diverse fish population; 29 species are known to be present (DNR Bureau of Fish Management, unpubl. data).

Approximately \$12,225 has been spent on stocking walleyes in Lake Noquebay over the last 15 years. This survey cost approximately \$4,500. Of an average annual stocking of more than 28,000 walleye fingerlings, only about an estimated 1,000 are harvested yearly. Comparative cost/benefit information like this can only be obtained from comprehensive survey.

In general there is a lack of good quantitative creel census data from lakes in Wisconsin. We spend a great deal of money every year in the management of these waters, but we know very little about the actual use they are receiving. The cost to conduct these creel surveys may seem high, but the benefits that are obtained in the long run greatly outweigh the initial costs.

ACKNOWLEDGMENTS

The author is grateful to Paul Alane, who worked the irregular hours necessary to collect the creel data, and to Lloyd Andrews, Milt Burdick, Dave Hanson, and Max Johnson, who reviewed the paper and made some helpful suggestions. Thanks also to Sue Hanson for typing the original manuscript and to Juanita Hegge for typing the report.

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Table 1. Species of fish known to be present in Lake Noquebay, Marinette County (from unpublished data, DNR Bureau of Fish Management files).

Common Name	Scientific Name
Northern pike	<u>Esox lucius</u>
Walleye	<u>Stizostedion vitreum</u>
Largemouth bass	<u>Micropterus salmoides</u>
Smallmouth bass	<u>Micropterus dolomieu</u>
Muskellunge	<u>Esox masquinongy</u>
Brook trout	<u>Salvelinus fontinalis</u>
Brown trout	<u>Salmo trutta</u>
Black bullhead	<u>Ictalurus melas</u>
Brown bullhead	<u>Ictalurus nebulosus</u>
Yellow bullhead	<u>Ictalurus natalis</u>
Bluegill	<u>Lepomis macrochirus</u>
Yellow perch	<u>Perca flavescens</u>
Black crappie	<u>Pomoxis nigromaculatus</u>
Rock bass	<u>Ambloplites rupestris</u>
Pumpkinseed	<u>Lepomis gibbosus</u>
Warmouth	<u>Lepomis gulosus</u>
White sucker	<u>Catostomus commersoni</u>
Shorthead redhorse	<u>Moxostoma macrolepidotum</u>
Longnose gar	<u>Lepisosteus osseus</u>
Northern hog sucker	<u>Hypentelium nigricans</u>
Bowfin	<u>Amia calva</u>
Bluntnose minnow	<u>Pimephales notatus</u>
Common shiner	<u>Notropis cornutus</u>
Logperch	<u>Percina caprodes</u>
Spottail shiner	<u>Notropis hudsonius</u>
Central mudminnow	<u>Umbra limi</u>
Johnny darter	<u>Etheostoma nigrum</u>
Mimic shiner	<u>Notropis volucellus</u>
Golden shiner	<u>Notemigonus crysoleucas</u>

Table 2. Fishing pressure and harvest rates on Midwestern lakes.

Lake	Reference	Size (acres)	Angler- Hours/Acre	Fish Harvest/Hour
Escanaba Lake, WI (24-year avg.)	(Kempinger et al. 1975)	293	65	0.84
Many Point Lake, MN (3-year avg.)	(Olson 1958)	1,716	17	0.54
Murphy Flowage, WI (15-year avg.)	(Snow 1978)	180	74	1.88
Ridge Lake, IL (21-year avg.)	(Bennett et al. 1969)	18	219	0.75
14 Minnesota lakes (1 year)	(Johnson and Kuehn 1956)	220-1,783	38	0.79
12 Michigan lakes (5-year avg.)	(Christensen 1953)	117-675	119	1.22
8 Michigan lakes (12-year avg.)	(Patriarche 1960)	1-130	21	0.81
Stormy Lake, WI (1 summer only)	(McKnight and Serns 1974)	522	16	0.62
Laura Lake, WI (1 summer only)	(McKnight and Serns 1974)	599	20	0.58
Black Oak Lake, WI (1 summer only)	(McKnight and Serns 1974)	584	19	0.74
Devils Lake, WI (2-year avg.)	(Brynildson et al. 1970)	379	106	0.77
Lake Noquebay, WI (Open water only)	(Current study)	2,409	34	1.28
Lake Winnebago, WI (1-year study)	(L. Meyers, pers. comm.)	137,708	3.8	0.42

Table 3. Estimated number of fish harvested from Lake Noquebay,
May-September 1977.

Species	Number Harvested	Percentage of Total Harvest
Bluegill	79,538	73
Pumpkinseed	17,191	16
Rock bass	4,400	4
Northern pike	3,734	3
Yellow perch	1,675	1.5
Largemouth bass	1,356	1
Black crappie	602	0.5
Walleye	546	0.5
Warmouth	200	0.5
Bullhead	93	0.5
Smallmouth bass	78	0.5

Table 4. Mean total length of fish from angler's catch on Lake Noquebay, May-September 1977.

Species	Number Measured	Avg. Length (in)
Bluegill	1,023	6.9
Pumpkinseed	320	6.2
Rock bass	83	7.9
Northern pike	114	18.2
Yellow perch	19	7.0
Largemouth bass	25	11.2
Black crappie	13	9.5
Walleye	19	16.3
Warmouth	1	7.7
Smallmouth bass	1	14.7

Table 5. Harvest rates of various fish species taken from Lake Noquebay, May-September 1977.

Species	Harvest Rate (fish/hour)					
	Overall	May	June	July	August	September
Bluegill	0.8959	1.2420	1.0921	1.1330	0.5558	0.3786
Pumpkinseed	0.2192	0.7076	0.0408	0.0670	0.0545	0.0194
Northern pike	0.0578	0.0975	0.0363	0.0201	0.0260	0.0194
Rock bass	0.0504	0.0824	0.0589	0.0492	0.0338	0.0194
Yellow perch	0.0188	0.0134	0.0196	0.0134	0.0364	0.0243
Largemouth bass	0.0168	0.0319	0.0151	0.0089	0.0104	0.0146
Walleye	0.0090	0.0084	0.0060	0.0045	0.0026	0.0194
Black crappie	0.0074	0.0118	0.0030	0.0089	0.0052	0.0049
Warmouth	0.0031	0.0084	0.0015	-	-	-
Bullhead	0.0012	0.0034	0.0015	-	-	-
Smallmouth bass	0.0008	0.0017	-	-	0.0026	-
All species	1.2803	2.2084	1.2749	1.3050	0.7273	0.5000

Table 6. Baits used by anglers fishing Lake Noquebay (based on percentages of 1,102 anglers interviewed).

Bait Used	Percentage of All Bait					
	Overall	May	June	July	August	September
<u>Live Bait</u>	75	79	79	81	62	55
Worms	71	75	77	75	58	52
Minnows	2	3	2	1	0	0
Other	2	1	<1	5	4	3
<u>Artificial Bait</u>	16	20	15	10	16	16
<u>Combination</u> (Live and Artificial)	9	1	6	9	22	29

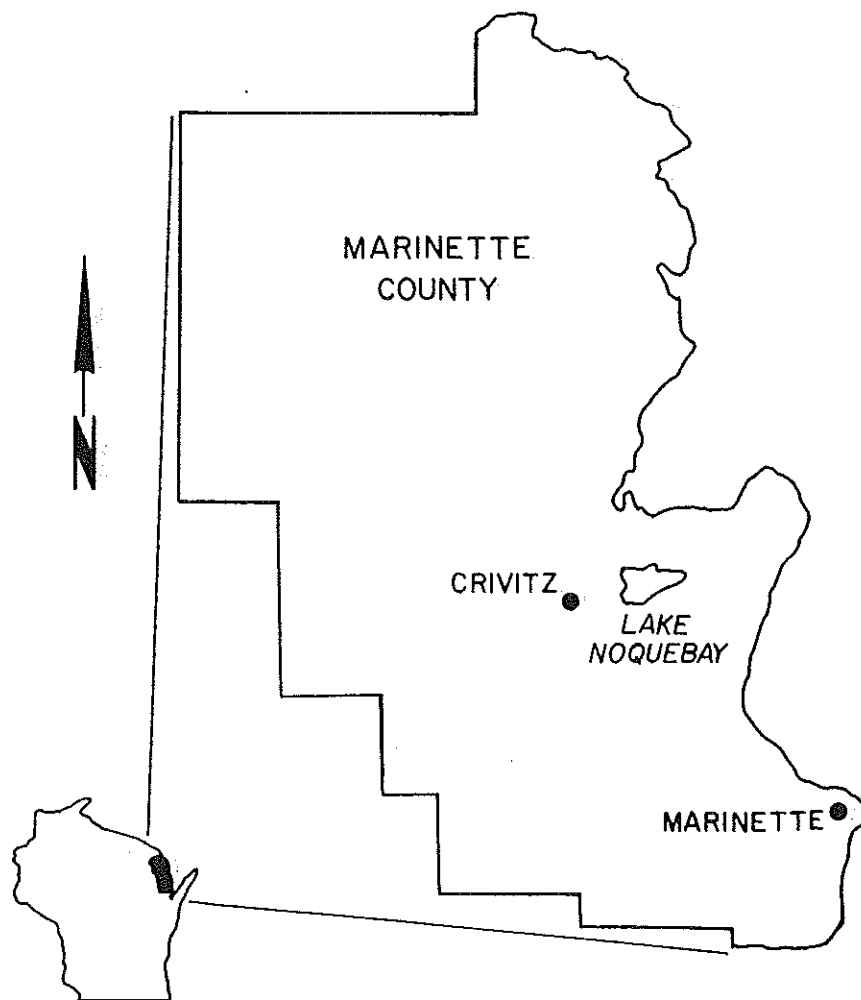


FIGURE 1. Location of Lake Noquebay, Marinette County, Wisconsin.

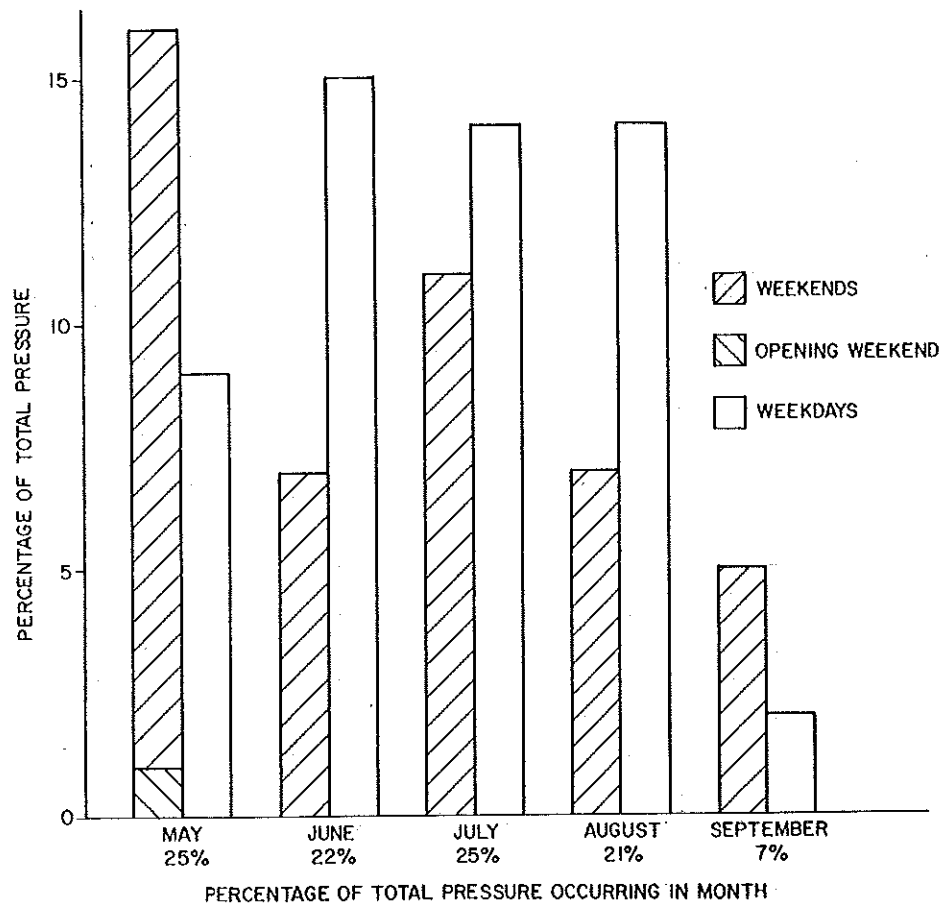


FIGURE 3. Distribution of fishing pressure by month on Lake Noquebay, Marinette County, Wisconsin, 1977.

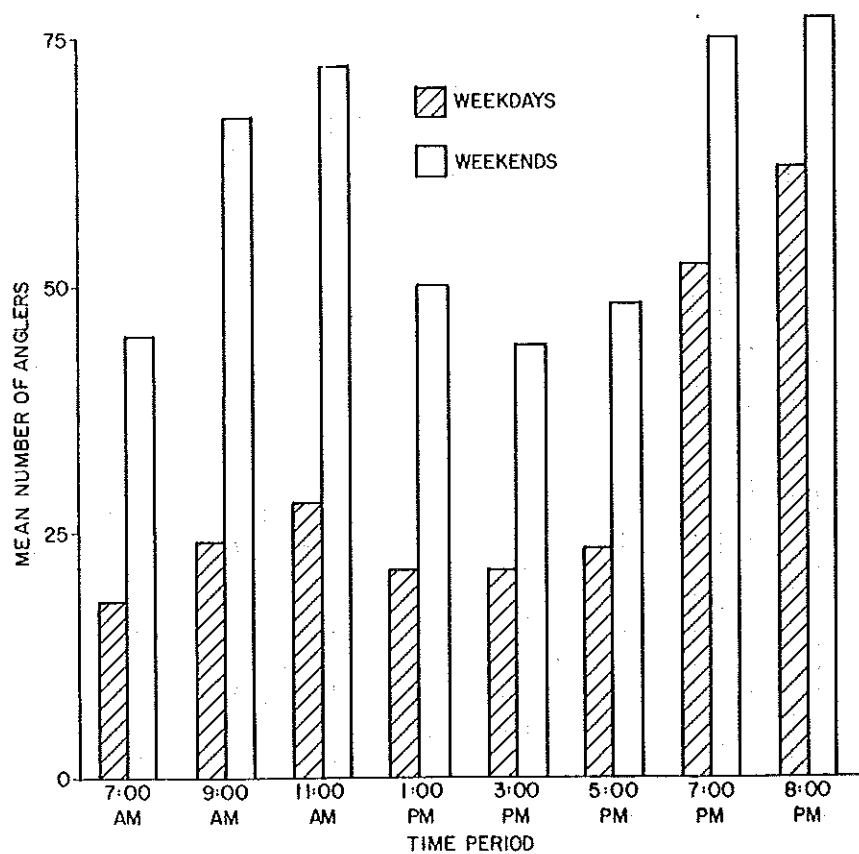


FIGURE 4. Distribution of daily fishing pressure by time period on Lake Noquebay, Marinette County, Wisconsin, 1977.

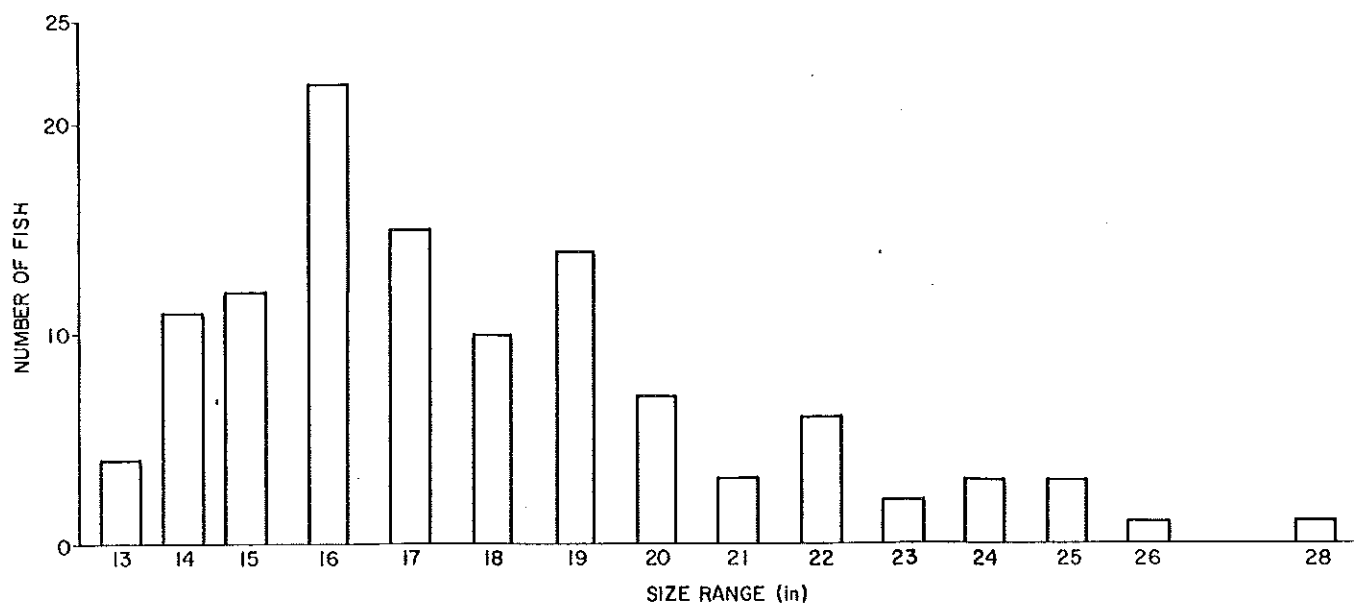


FIGURE 5. Length frequency of angler-caught northern pike from Lake Noquebay, Marinette County, Wisconsin, 1977.

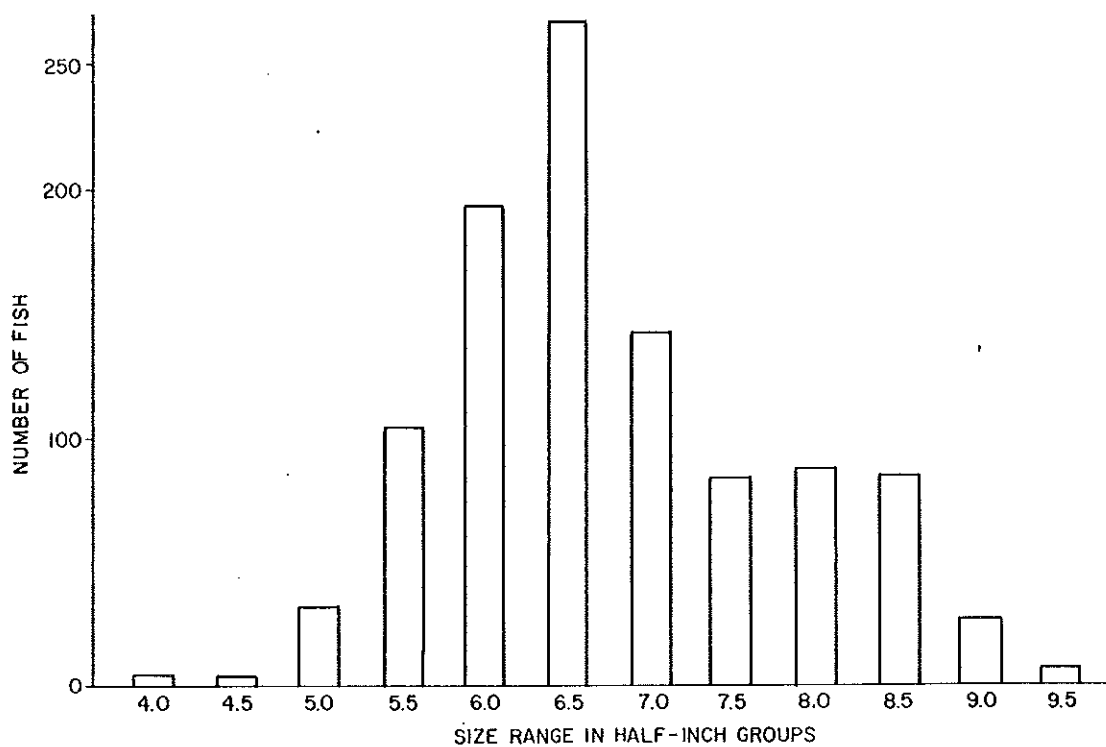


FIGURE 6. Length frequency of angler-caught bluegills from Lake Noquebay, Marinette County, Wisconsin, 1977.

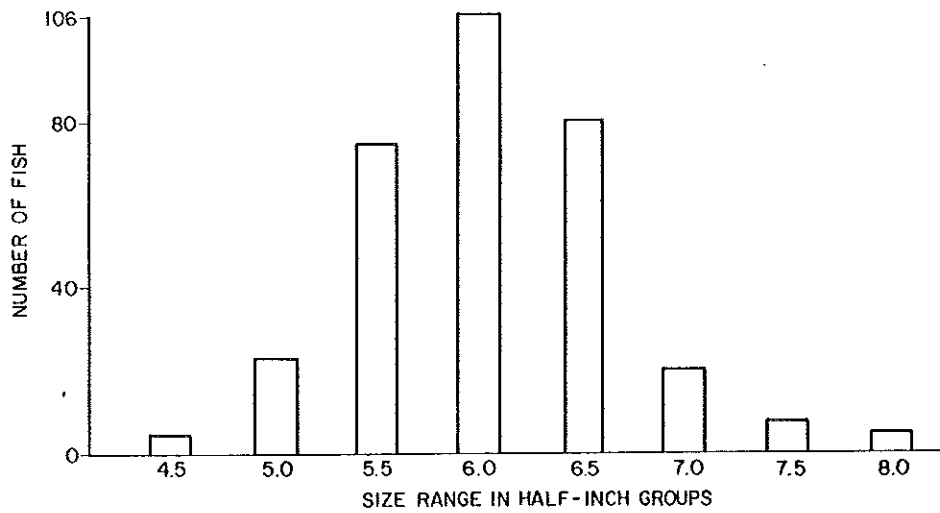


FIGURE 7. Length frequency of angler-caught rock bass from Lake Noquebay, Marinette County, Wisconsin, 1977.

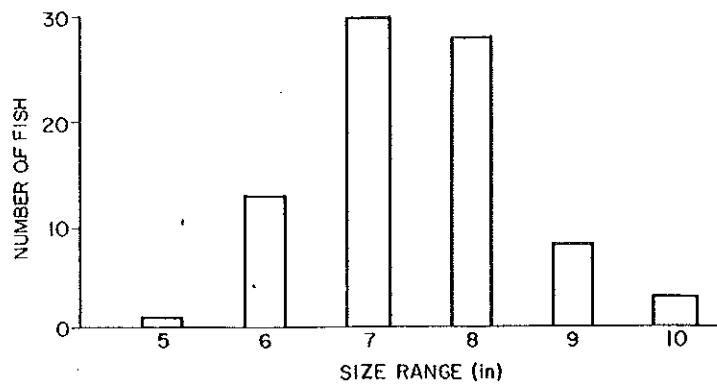


FIGURE 8. Length frequency of angler-caught pumpkinseeds from Lake Noquebay, Marinette County, Wisconsin, 1977.

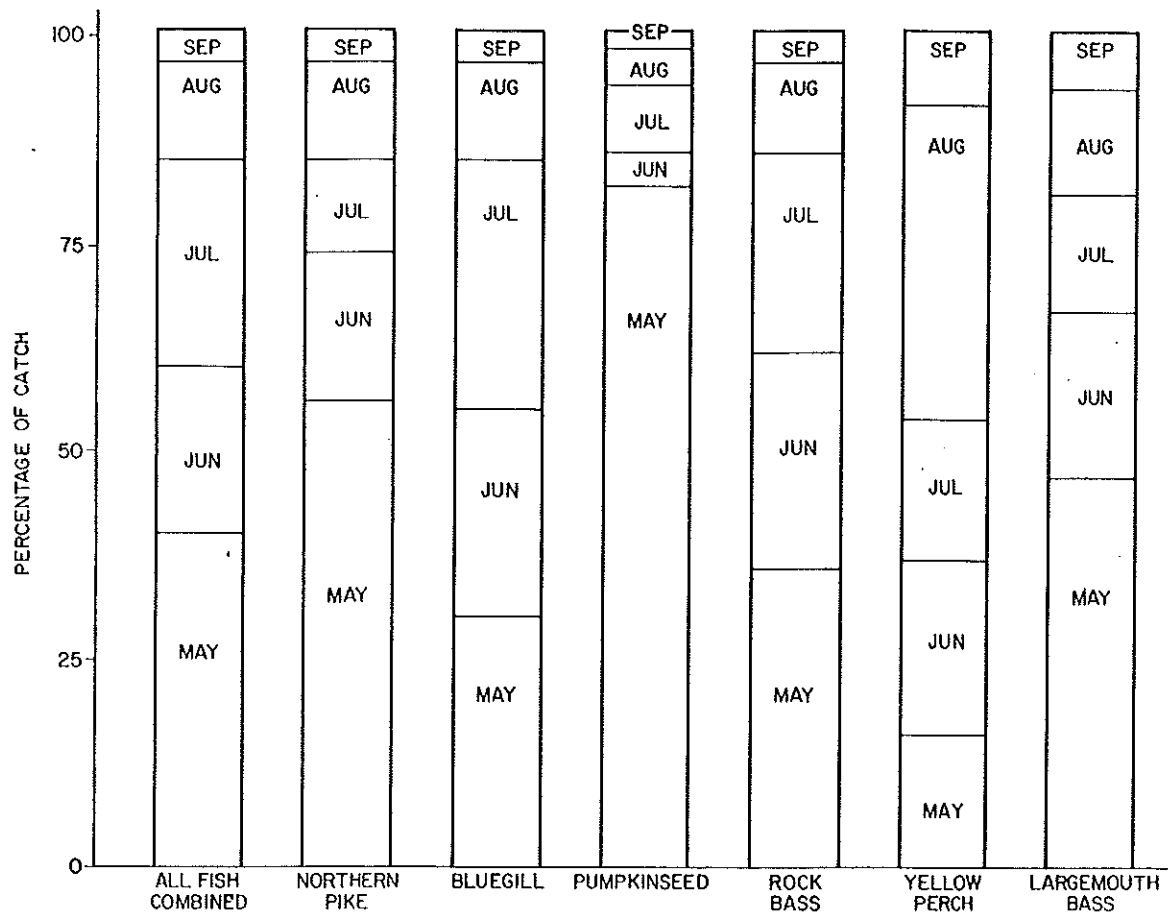


FIGURE 9. Angler harvest by month from Lake Noquebay, Marinette County, Wisconsin, 1977.

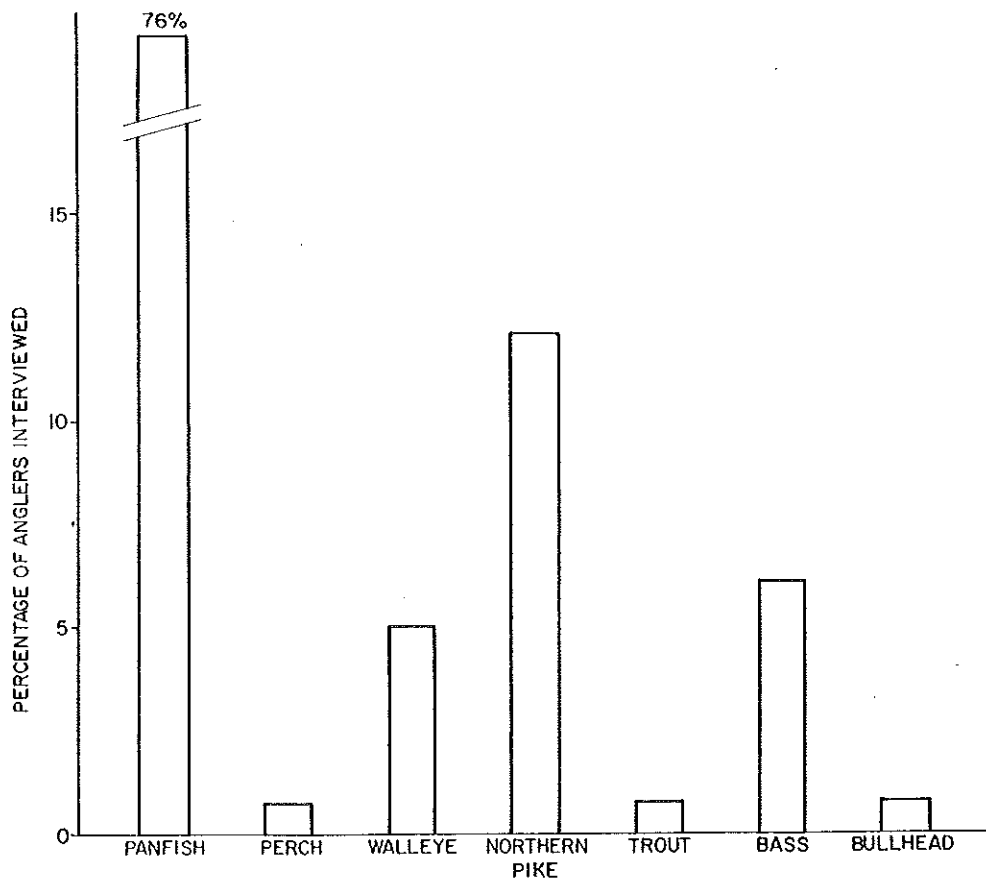


FIGURE 10. Fish species sought by anglers in Lake Noquebay, Marinette County, Wisconsin, 1977.

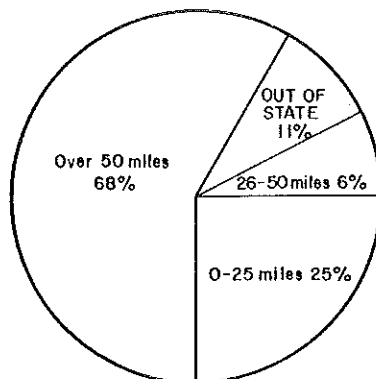


FIGURE 11. Distance anglers traveled to fish Lake Noquebay, Marinette County, Wisconsin, 1977.

APPENDIX: Sample angler interview form

COUNTY	CODE	NAME OF WATER	CODE	DATE (MO.-DAY-YR.)
				-- / -- / --
WATER TYPE				SHEET NUMBER
<input type="checkbox"/> 1. LAKE <input type="checkbox"/> 2. STREAM <input type="checkbox"/> 3. IMPOUNDMENT				

FISH SPECIES CODE L. STURGEON 010 SHOVELNOSE 012 L. WHITEFISH 082 COHO 090 CHINOOK 091 RAINBOW 092 ATLANTIC SAL. 093 BROWN 094 BROOK 095 LAKE T. 096 TIGER T. 097 NORTHERN P. 121 MUSKIE 122 HYB. MUSKIE 123 CARP 134 WHT. SUCKER 194 BLACK BH 221 YELLOW BH 222 BROWN BH 223 CHANNEL CAT 224 FLATHEAD CAT 229 BURBOT 260 WHITE BASS 300 YELLOW BASS 301 ROCK BASS 310 GREEN SF 311 PUMPKIN S. 312 WARMOUTH 313 BLUEGILL 315 SM BASS 318 LM BASS 319 W. CRAPPIE 320 B. CRAPPIE 321 Y. PERCH 343 SAUGER 349 WALLEYE 350 FW DRUM 360 OTHER	NUMBER OF ANGLERS IN 1. PARTY INTERVIEWED NUMBER OF ANGLERS IN PARTY 2. WERE ANGLERS THE: DRIVER PASSENGER NO CAR 3. AGE: UNDER 16 16-64 65 AND OVER 4. SEX 5. ANGLER RESIDENCE: CITY COUNTY STATE RANGE CODE .. 6. LICENSE: NONE NON-RES. ANN. RES. NON-RES. FAM. PERM. RES. NON-RES. 15 D RES. COMB. NON-RES. 4 D RES. SPORT	7. TIME STARTED FISHING TIME ENDED FISHING TIME INTERVIEWED COMPLETED FISHING <input type="checkbox"/> YES <input type="checkbox"/> NO 8. SPECIFICALLY FISHING FOR: (CODE) A. B. 9. ANGLING METHOD USED: BAIT CAST. JIG-POLE FLY TIP-UP SPIN SNAGGING STILL SPEARING TROLL OTHER 10. FISHING WAS FROM: PIER BOAT SHORE ICE WADING 11. BAITS USED: WORM MINNOW PREPARED BAIT FLY PLUG SPOON SPINNER JIG OTHER 12. COMMENTS:
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13.	SPECIES CODE	---	---	---	---	---	---	---
14.	NO. OF FISH KEPT							
15.	NO. OF FISH RELEASED							

16.	SPECIES	LENGTH	WEIGHT	TAG TYPE	TAG/FINCLIP	OLD SCARS	FRESH WOUNDS	OTHER
A.								
B.								
C.								
D.								
E.								
F.								
G.								
H.								
I.								
J.								
K.								
L.								
M.								
N.								
O.								

Instructions (Form 3600-107)

Transfer the county, name of water, date, and water type data from the cover sheet (Form 3600-106). Since there will be many interview forms/cover sheet/ day, the sheet no. can be used as a page number or as a cumulative total of interviews as the season progresses.

1. List the number of angler(s) being interviewed and the number of angler(s) in each party.
2. List the number of driver(s) and passengers in each interviewed group. List the number of anglers that didn't come by car.
3. List the number of anglers in the appropriate age slots; if not applicable, leave blank.
4. Use M or F; if interviewing a group, leave blank.
5. Write in the resident information. Range codes are as follows:
 - 1 = residence within 0-25 miles of angling site.
 - 2 = residence within 26-50 miles of angling site.
 - 3 = residence is over 50 miles from angling site but still in Wisconsin.
 - 4 = residence is out-of-state.When 1 or 2 are applicable to 4, check two slots. Otherwise check only one slot. If angler residence varies within the party, leave blank.
6. List the number of each license type used in each party.
7. Use military time. List the time when angling started and ended. If angler(s) are still fishing, leave "time ended fishing" blank. List the time of the angler interview. Check yes or no for completed fishing.
8. Write in the fish species the angler(s) are specifically after. If angler(s) are not after any particular species, leave blank. Also list the code from the Species Code Column. If species are not found in code column, see MC 3606.1.
9. List the number of each angling method used in each party. List the method for "other" on the appropriate line.
10. List the number in each fishing location used by each party.
11. List the number of each bait-types used in each party.
12. (For personal use only - this data will not be keypunched.)
13. List the appropriate species from the code column.
14. List the total number of each fish species kept in the creel under the corresponding species code.
15. List the total number of each fish species released under the corresponding species code.
16. This block is for fishery data. List each species by code being sampled in column a-o. Use the inches and pounds for length-weight. Write in type of tag, if available, along with the tag number or finclip code (see Fish Management Handbook, Finclip code, p. 17-2). Describe scars, wounds, and other items, though these will not be key punched unless specifically directed.

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